

CLAIMS

Therefore, having thus described the disclosure, at least the following is claimed:

- 1 1. An apparatus for detecting a selected material that changes an effective
2 dielectric constant of a circular resonator, the apparatus comprising:
3 an input waveguide being capable of receiving electromagnetic wave;
4 an output waveguide; and
5 a circular resonator located adjacent to the input and output such that the
6 electromagnetic wave is coupled in and out of the circular resonator, the resonator
7 being capable of bonding to the selected material such that the selected material
8 changes the power of the electromagnetic wave in the circular resonator,
9 wherein the output waveguide receives the change in the power of the electromagnetic
10 wave in the circular resonator.
- 1 2. The apparatus as defined in claim 1, wherein the circular resonator causes the
2 electromagnetic wave to travel many times within the circular resonator during a
3 build-up stage, the electromagnetic wave being interactive with the selected material
4 many times causing the change in the power of the electromagnetic wave in the
5 circular resonator.
- 1 3. The apparatus as defined in claim 1, wherein the electromagnetic wave
2 stabilizes at resonance condition in the circular resonator and the selected material
3 bonded to the circular resonator causes the power of the electromagnetic wave at
4 resonance condition in the circular resonator to change.
- 1 4. The apparatus as defined in claim 1, wherein the input and output waveguides
2 are substantially straight.
- 1 5. The apparatus as defined in claim 1, wherein the circular resonator is shaped
2 as one of a ring and racetrack waveguide.

1 6. The apparatus as defined in claim 1, wherein the selected material is one of a
2 chemical substance and bio-agent.

1 7. The apparatus as defined in claim 1, wherein the circular resonator further
2 comprises a cladding layer, wherein the selected material is capable of changing the
3 dielectric constant of the cladding layer.

1 8. The apparatus as defined in claim 1, wherein the input and output waveguides
2 are substantially parallel to each other and the circular resonator is located between
3 the waveguides.

1 9. The apparatus as defined in claim 1, wherein the resonator being capable of
2 bonding to the selected material is in direct contact or in close proximity with the
3 selected material.

1 10. The apparatus as defined in claim 1, further comprising another circular
2 resonator located adjacent to the circular resonator and between the waveguides
3 forming a cascade arrangement.

1 11. The apparatus as defined in claim 1, further comprising a fluidic channel that
2 the selected material can pass through and interact with the circular resonator.

1 12. The apparatus as defined in claim 1, further comprising:
2 another circular resonator;
3 another input waveguide; and
4 another output waveguide, wherein the input waveguides are arranged
5 substantially in parallel to each other, the output waveguides are arranged
6 substantially in parallel to each other and substantially perpendicular to the parallel
7 input waveguides, the circular resonators being located in the center of the input and
8 output waveguides forming an array arrangement.

- 1 13. A method for detecting a selected material that changes an effective dielectric
2 constant of a circular resonator, the method comprising the steps of:
3 inputting an electromagnetic wave into an input waveguide;
4 coupling the electromagnetic wave received by the input waveguide to a
5 circular resonator;
6 bonding the selected material to the circular resonator such that the selected
7 material changes the power of the electromagnetic wave in the circular resonator; and
8 receiving electromagnetic wave in the circular resonator that was changed by
9 the bonding of the selected material to the circular resonator.
- 1 14. The method as defined in claim 13, further comprising causing the
2 electromagnetic wave to travel many times within the circular resonator during a
3 build-up stage, wherein the electromagnetic wave interacts with the selected material
4 many times causing the change in the power of the electromagnetic wave in the
5 circular resonator.
- 1 15. The method as defined in claim 13, further comprising stabilizing the
2 electromagnetic wave at resonance condition in the circular resonator, wherein the
3 selected material bonded to the circular resonator causes the power of the
4 electromagnetic wave at resonance condition in the circular resonator to change.
- 1 16. The method as defined in claim 13, further comprising bonding the selected
2 material to a cladding layer of the circular resonator, wherein the selected material is
3 capable of changing the dielectric constant of the cladding layer.
- 1 17. The method as defined in claim 13, wherein attaching the selected material to
2 the circular resonator further comprises the selected material being in direct contact or
3 in close proximity with the circular resonator.
- 1 18. The method as defined in claim 13, further comprising providing another
2 resonator forming a cascade arrangement.

- 1 19. The method as defined in claim 13, further comprising providing another
2 resonator, another input waveguide and another output waveguide forming an array
3 arrangement.
- 1 20. The method as defined in claim 13, wherein the input and output waveguides
2 are substantially straight.
- 1 21. The method as defined in claim 13, wherein the circular resonator is one of a
2 ring or racetrack resonator.
- 1 22. The method as defined in claim 13, further comprising providing a fluidic
2 channel located on top of the circular resonator.
- 1 23. The method as defined in claim 13, further comprising providing a cladding
2 layer to the circular resonator.
- 1 24. The method as defined in claim 13, further comprising placing the input and
2 output waveguides substantially in parallel to each other and placing the circular
3 resonator between the waveguides.
- 1 25. A method for detecting the presence of a chemical or bio-agent, the method
2 comprising the steps of:
3 inputting an electromagnetic wave into an input waveguide;
4 coupling the electromagnetic wave received by the input waveguide to a
5 circular resonator;
6 bonding the chemical or bio-agent to the circular resonator such that the
7 chemical or bio-agent changes the power of the electromagnetic wave in the circular
8 resonator; and
9 receiving electromagnetic wave in the circular resonator that was changed by
10 the bonding of the chemical or bio-agent to the circular resonator.

- 1 26. The method as defined in claim 25, further comprising causing the
2 electromagnetic wave to travel many times within the circular resonator during a
3 build-up stage, wherein the electromagnetic wave interacts with the selected material
4 many times causing the change in the power of the electromagnetic wave in the
5 circular resonator.
- 1 27. The method as defined in claim 25, further comprising stabilizing the
2 electromagnetic wave at resonance condition in the circular resonator, wherein the
3 selected material bonded to the circular resonator causes the power of the
4 electromagnetic wave at resonance condition in the circular resonator to change.
- 1 28. The method as defined in claim 25, further comprising bonding the chemical
2 or bio-agent to a cladding layer of the circular resonator, wherein the chemical or bio-
3 agent is capable of changing the dielectric constant of the cladding layer.
- 1 29. The method as defined in claim 25, wherein bonding the chemical or bio-agent
2 to the circular resonator further comprises the chemical or bio-agent being in direct
3 contact or in close proximity with the circular resonator.
- 1 30. The method as defined in claim 25, further comprising providing another
2 resonator forming a cascade arrangement.
- 1 31. The method as defined in claim 25, further comprising providing another
2 resonator, another input waveguide and another output waveguide forming an array
3 arrangement.
- 1 32. The method as defined in claim 25, wherein the input and output waveguides
2 are substantially straight.
- 1 33. The method as defined in claim 25, wherein the circular resonator is one of a
2 ring or racetrack resonator.

1 34. The method as defined in claim 25, further comprising providing a fluidic
2 channel located on top of the circular resonator.

1 35. The method as defined in claim 25, further comprising providing a cladding
2 layer to the circular resonator.

1 36. The method as defined in claim 25, further comprising placing the input and
2 output waveguides substantially in parallel to each other and placing the circular
3 resonator between the waveguides.